

ATTACHMENT B - Receiving Waters Information

1. Excerpt from Final 2010 305(b)/303(d) Water Quality Assessment Integrated Report Attachment A for waterbody Jackson River/James River segment VAW-I09R as List of Impaired (Category 5) Waters in 2010
2. Excerpt from Jackson River Benthic TMDL indicating the facility allocations. Includes discussion of Flow Augmentation with Pulses from Gathright Dam with US Army Corps of Engineers as modification of 216 Study.
3. December 30, 2011 Flow Frequency Memorandum
4. Spreadsheet of STORET data from station JKS030.65 - Route 697 Bridge over the Jackson River at Clearwater Park - upstream temperature, pH and hardness
5. August 29, 2011 memo from Virginia Department of Health, Office of Water Programs, Lexington Field Office stating no public water supply raw water intakes within 15 miles downstream of discharge.

Appendix A - List of Impaired (Category 5) Waters in 2010

James River Basin

Cause Group Code: 109R-01-BEN **Jackson River**

Location: Jackson River mainstem from the Westvaco main processing outfall downstream to the confluence of the Jackson and Cowpasture Rivers.

City / County: Alleghany Co. Covington City

Use(s): Aquatic Life

Cause(s) /

VA Category: Benthic-Macroinvertebrate Bioassessments / 5A

The original 1996 VAW-104R and VAW-109R impairments were combined into one in 2002.

2010 Benthic Assessment station locations are:

- 2-JKS000.38 - Rt. 727 Bridge - near Iron Gate (109R)
- 2-JKS006.67 - Low Water Bridge - near Dabney Lancaster CC (109R)
- 2-JKS013.29 - Off Rt. 696 above Lowmoor (109R)
- 2-JKS018.68 - Rt. 18 Bridge at Covington (109R)
- 2-JKS020.41- Upper Horse Shoe at Rayon Terrace (109R)
- 2-JKS022.78- Fudge's Bridge, Rt. 154, Covington (109R)
- 2-JKS023.61 - City Park - Covington at gage (109R)

The 1996 originally 303(d) Listed impairments to the benthic community are believed due to nutrient and organic enrichment (deposition) for 24.18 miles. Based on ambient station solids data, the nutrients and organics are mainly dissolved. Trend analysis finds a significant declining trend for total phosphorus. Maxima have been greatly reduced since 1996. These waters remain impaired until completion of the Jackson R. TMDL Study.

General Standard (Benthic):

2-JKS023.61-Bio 'IM' Seven Virginia Stream Condition Index (VSCI) surveys (2003 - 2008) for 2010; lowest score spring 2007 32.92 and highest score 57.38 spring 2004. The spring 2006 score is 34.36. The invertebrate community at this site has been dominated by taxa that are tolerant of environments with low dissolved oxygen and high levels of organic pollution (i.e. Tubificidae, Tricladida, Chironomidae, Lumbriculidae and Simuliidae). The VSCI scores display a negative alteration in the taxonomic diversity and pollution sensitivity of the benthic community. Elevated total phosphorus levels continue although maxima are reduced where 6 of 40 samples are above 0.20 mg/l - 'Observed Effect'. The maximum value is 0.40 mg/l and the lowest 0.28 mg/l. Past values above 0.20 have been greater than 1.40 mg/l. The 2008 Integrated Report (IR) assessed seven VSCI surveys (2001 - 2006); lowest score spring 2001 31.03 and highest score 52.38 spring 2004. The spring 2006 score is 34.36. 2008 elevated total phosphorus levels were 17 of 51 samples above 0.20 mg/l - 'Observed Effect'. The maximum value is 1.40 mg/l and the lowest 0.23 mg/l.

2-JKS022.78- 2010 Elevated TP values greater than 0.20 mg/l are found in two of 12 samples with excessive values ranging from 0.28 to 0.39 mg/l.

2-JKS020.41- A 2007 probability station. Bio 'IM' Two VSCI surveys (2007), average score 48.13. The invertebrate community at this site is dominated by taxa that are tolerant of environments with low dissolved oxygen and high levels of organic pollution (i.e. Tricladida and Asellidae).

2-JKS018.68- Bio 'IM' Five VSCI surveys (2004, 2006-2008) with a 6 year average score of 54.28. The benthic community shows some improvement at this station relative to the station at City Park (2-JKS023.61). However, the benthic community remains dominated by pollution tolerant taxa. In 2010 two of 16 total phosphorus observations are greater than 0.20 mg/l; excessive values range from 0.22 to 0.3 mg/l. The 2008 assessment reports two VSCI scores from the fall of 2004 (67.3) and 2006 (51.8). 2008 assessment TP results find no elevated TP levels above 0.20 mg/l from nine observations (no additional data). The 2006 IR reported six of 18 observations greater than 0.20 mg/l. Elevated TP values ranged from 0.30 to 0.70 mg/l.

2-JKS013.29- 2010 results find an impaired condition with the lowest at 38.6 fall 2004 and the highest at 61.3 fall 2006 from six VSCI survey scores (2003, 2004, 2006 & 2007). Lower VSCI scores are the result of the low taxonomic diversity and lack of pollution sensitive taxa. The 2008 IR found impairment from

Appendix A - List of Impaired (Category 5) Waters in 2010

James River Basin

four VSCI surveys (2003 - 2004 & 2006). The Low Moor station through the 2008 assessment has consistently had lower assessment scores and higher numbers of pollution tolerant organisms than at 2-JKS018.68. The 2006 sample showed an increase in pollution sensitive taxa and a decrease in pollution tolerant taxa. There are no additional total phosphorous data within the 2010 data window. 2008 elevated TP levels above 0.20 mg/l are found in six of 12 samples with excessive values ranging from 0.29 to 1.41 mg/l- 'Observed Effect'.

The 2008 IR found impairment from four VSCI surveys (2003 - 2004 & 2006). The Low Moor station through the 2008 assessment has consistently had lower assessment scores and higher numbers of pollution tolerant organisms than at 2-JKS018.68.

2-JKS006.67- 2010 results find 'Full Support' from six VSCI surveys (2003-2008) with an average six year score of 61.2. There have been slight differences in scores over the six-year period. Spring scores have been lower than fall scores. Lower VSCI scores are the result of the decrease in pollution sensitive taxa. Recent improvements in the benthic community may be due to a reduction in cooling water discharge and efforts to reduce nutrient discharge to the river. One elevated TP value is found at 0.26 mg/l from six samples within the 2010 data window. Trend analysis at 2-JKS000.38 reports a significant declining trend in total phosphorus. The 2008 IR reports four VSCI surveys (2001-2004) showing overall impairment with an average score of 52.8. Elevated TP concentrations greater than 0.20 mg/l are found in eight of 21 observations ranging from 0.21 to 0.50 mg/l- 'Observed Effect'.

2-JKS000.38- The 2010 assessment finds a single elevated TP observation greater than 0.20 mg/l from 38 observations at 0.22 mg/l. The 2008 assessment reported elevated TP observations greater than 0.20 mg/l in 15 of 50 observations- 'Observed Effect'. Values above 0.20 mg/l range from 0.22 to 1.24 mg/l. Trend analysis reveals significant declining trends in bacteria, total phosphorus and nitrogen.

Jackson River Aquatic Life	Benthic-Macroinvertebrate Bioassessments - Total Impaired Size by Water Type:			
	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)	24.18

Sources:

Industrial Point Source Discharge	Municipal (Urbanized High Density Area)	Municipal Point Source Discharges
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Appendix A - List of Impaired (Category 5) Waters in 2010

James River Basin

Cause Group Code: 109R-01-DO **Jackson River**

Location: Jackson River mainstem from the Westvaco main processing outfall downstream to just above the Lowmoor community.

City / County: Alleghany Co. Covington City

Use(s): Aquatic Life

Cause(s) /

VA Category: Oxygen, Dissolved / 5A

The original 1998 IDs, VAW-104R and VAW-109R, 1996 303(d) Listed dissolved oxygen impairment was combined into one in 2002 for 11.19 miles.

2008 Assessment station locations are:

2-JKS000.38 - Rt. 727 Bridge - near Iron Gate (109R)

2-JKS013.29 - Off Rt. 696 above Lowmoor (109R)

2-JKS018.68 - Rt. 18 Bridge at Covington (109R)

2-JKS023.61 - City Park - Covington at gate (109R)

Diurnal swings in dissolved oxygen cause nonsupport of the aquatic life use for a total of 11.19 miles extending from river mile 24.21 (104R- 0.46 miles) to 13.02 (109R- 10.73 miles) (37°46'49.59 / 079°55'40.00").

The DO impairment remains for final determination of Use support via the TMDL Study.

2-JKS023.61- The 2010 assessment reports no DO excursions of the 4 mg/l criterion from 48 measurements within the ambient monitoring program. The 2008 assessment also found no DO measurements in excess of the DO minimum criterion from 52 observations. However diurnal effects have been noted in previous assessments. The 2004 IR reports DO exceeds the WQS minimum of 4.0 mg/l in six of 26 1998 special study observations as well as those described below at 2-JKS022.15.

Elevated total phosphorus (TP) levels continue with the 2010 assessment where TP results find six of 40 observations above 0.20 mg/l- 'Observed Effect'. Excessive values range from 0.28 to 0.40 mg/l. 2008 elevated TP levels are found in 17 of 51 samples with a maximum value of 1.40 mg/l and minimum of 0.23 mg/l. 2006 TP concentrations are elevated in 25 of 48 samples with excessive values also ranging from 0.23 to 1.40 mg/l. Trend analysis reveals significant declining trends in total phosphorus.

2-JKS022.15- 2004 IR reports 1998 DO Recordings find 222 excursions of the minimum 4.0 mg/l WQS criterion from 481 measurements; Diurnal affects are noted. These data are older than 5 years.

2-JKS018.68- Twenty DO measurements find no excursions of the 4.0 mg/l criterion for the 2010 assessment. DO data within the 2008 assessment data window find no excursions of the 4.0 mg/l minimum criterion from 10 measurements. However diurnal effects have been noted in previous assessments.

Two of 16 TP samples are elevated above 0.20 mg/l with the 2010 assessment. Excessive values range from 0.22 to 0.30 mg/l. 2008 TP assessment results find no elevated TP levels from nine observations with no additional data beyond the 2006 IR. The 2006 IR reports six of 18 observations in excess of 0.20 mg/l. TP excursions ranged from 0.30 to 0.70 mg/l.

2-JKS013.29- Ambient data within the 2008 assessment data window report no excursions of the WQS criteria for DO. However diurnal effects have been noted in previous assessments. The 2008 IR reports elevated TP above 0.20 mg/l in six of 12 samples with excessive values ranging from 0.29 to 1.41 mg/l- 'Observed Effect'.

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James River Basin

Jackson River
[Aquatic Life](#)

Oxygen, Dissolved - Total Impaired Size by Water Type:	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
			11.19

Sources:

- Industrial Point Source Discharge
- Municipal Point Source Discharges

Appendix A - List of Impaired (Category 5) Waters in 2010

James River Basin

Cause Group Code: 109R-01-PCB Jackson River

Location: The Jackson River from the Covington water intake downstream to just above the Lowmoor community.

City / County: Alleghany Co. Covington City

Use(s): Fish Consumption

Cause(s) /

VA Category: PCB in Fish Tissue / 5A

The 2008 Integrated Report produces the initial 303(d) Listing of these waters for a total of 12.43 miles.

2-JKS023.88 (Covington City Park) 2005 fish tissue collections find exceedances above the former WQS based PCB TV of 54 ppb (VDH 50) from a single species. Two carp are found with tissue values of 66.4 (68.0 cm) and 71.3 ppb (61.31 cm). Application of the new WQS of 20 ppb adds three additional carp sizes (63.9 cm) exceeding at 28.81 ppb, (63.2 cm) at 35.96 and (51-58 cm) at 37.48 ppb.

Jackson River Fish Consumption	PCB in Fish Tissue - Total Impaired Size by Water Type:			Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
						12.43

Sources:

Source Unknown

Appendix A - List of Impaired (Category 5) Waters in 2010

James River Basin

Cause Group Code: 109R-02-BAC **Jackson River**

Location: Jackson River mainstem from the Covington water intake downstream to just below the Lexington Avenue Bridge.

City / County: Alleghany Co. Covington City

Use(s): Recreation

Cause(s) /

VA Category: Escherichia coli / 5A

The original 3,36 mile waters were 1998 303(d) listed for fecal coliform (FC) bacteria and delisted for bacteria October 2005 as approved by the U.S. EPA (Fed. ID - NA) where only one exceedance from 24 observations are reported via the 2006 Integrated Report (IR) for Escherichia coli (E. coli) bacteria.

The bacteria impairment returned with the 2008 IR based on E. coli excursions at 2-JKS023.61. Data within the 2010 data window results in an additional extension of the impairment from stations 2-JKS018.68 and 2-JKS015.60. The impairment extends a total of 12.43 miles.

2-JKS023.61 (Covington City Park) 2010 results produce nine of 33 Escherichia coli (E. coli) observations in excess of the 235 cfu/100 ml instantaneous criterion. Exceeding values range from 320 to 1400 cfu/100 ml. 2008 IR found four of 27 E. coli observations in excess of the 235 cfu/100 ml instantaneous criterion. Exceeding values range from 250 to 1400 cfu/100 ml.

2-JKS018.68 (Rt. 8 Bridge at Covington) Three of 12 E. coli observations exceed 235 cfu/100 ml ranging from 550 to 380 cfu/100 ml.

2-JKS015.60 (K-Mart Parking Lot, SE corner) E. coli observations exceed the 235 cfu/100 ml criterion in two of 12 observations. Exceeding values range from 250 to 450 cfu/100 ml.

Jackson River Recreation	Escherichia coli - Total Impaired Size by Water Type:			Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
						12.43

Sources:

Municipal (Urbanized High Density Area) Sanitary Sewer Overflows (Collection System Failures) Urban Runoff/Storm Sewers

Benthic TMDL Development for the Jackson River, Virginia

Submitted to

Virginia Department of Environmental Quality

Prepared by



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2445 M Street, NW
Washington, DC 20037

June 2010

Final Report

7.0 Jackson River TMDL Allocations

The development of the allocations for the Jackson River TMDL is based on the Chesapeake Bay Modeling Scenario along with a restriction on PO₄-P discharges from the MeadWestvaco. This scenario stems from the fact that the Jackson River is part of the Chesapeake Bay Watershed as characterized in **Section 6.2**. Based on their findings, nitrogen and phosphorus discharges have been shown to impact the water quality in the Bay and its tidal rivers. As a result, the Virginia State Water Control Board (SWCB) proposed guidelines controlling the discharge of total nitrogen and total phosphorus within the Virginia portion of the Chesapeake Bay watershed. The Chesapeake Bay Scenario uses the calibrated WASP7 model implemented for the 2006 growing season (**Chapter 6**) with adjustments to the point source dischargers loads to reflect the EPA Chesapeake Bay future discharge guidelines depicted in **Table 7-1**. It should be noted that Clifton Forge STP (VA0022772) will be phased-out and replaced by the Lower Jackson River WWTP (VA0090671).

Table 7-1: Chesapeake Bay Recommended Nutrient Load Discharges

Facility Name	VPDES Permit	Discharge Flow (MGD)	TP Load (lbs/yr)	TP Conc. (mg/L)	TN Load (lbs/yr)	TN Conc. (mg/L)
MeadWestvaco	VA0003646	35.0	159,815	1.5	394,211	3.7
Covington STP	VA0025542	3.0	4,566	0.5	54,794	6.0
Low Moor WWTP	VA0027979	0.3	1,050	1.15	5,479	6.0
Lower Jackson River WWTP	VA0090671	2.6	3,957	0.5	47,488	6.0

The current discharge levels from the MeadWestvaco plant are much lower than the Chesapeake Bay recommended discharge levels shown above. In fact and based on recent DMR data, MeadWestvaco has reduced considerably its phosphorus discharge to the Jackson River. As shown in **Figure 7-1** the PO₄-P discharge levels from the MeadWestvaco Plant were considerably reduced during the period of 2003 to 2006 reaching a recorded and consistent discharge load of 8,550 lbs during the growing season from June to October 2006. This corresponds to an average PO₄-P discharge concentration of 0.21 mg/L. These discharge levels also indicate that this facility has

reached the limits of technology in terms of phosphorus reductions. Therefore, the 2006 nutrient loadings from MeadWestvaco were used along with the implementation the Chesapeake Bay Modeling scenario.

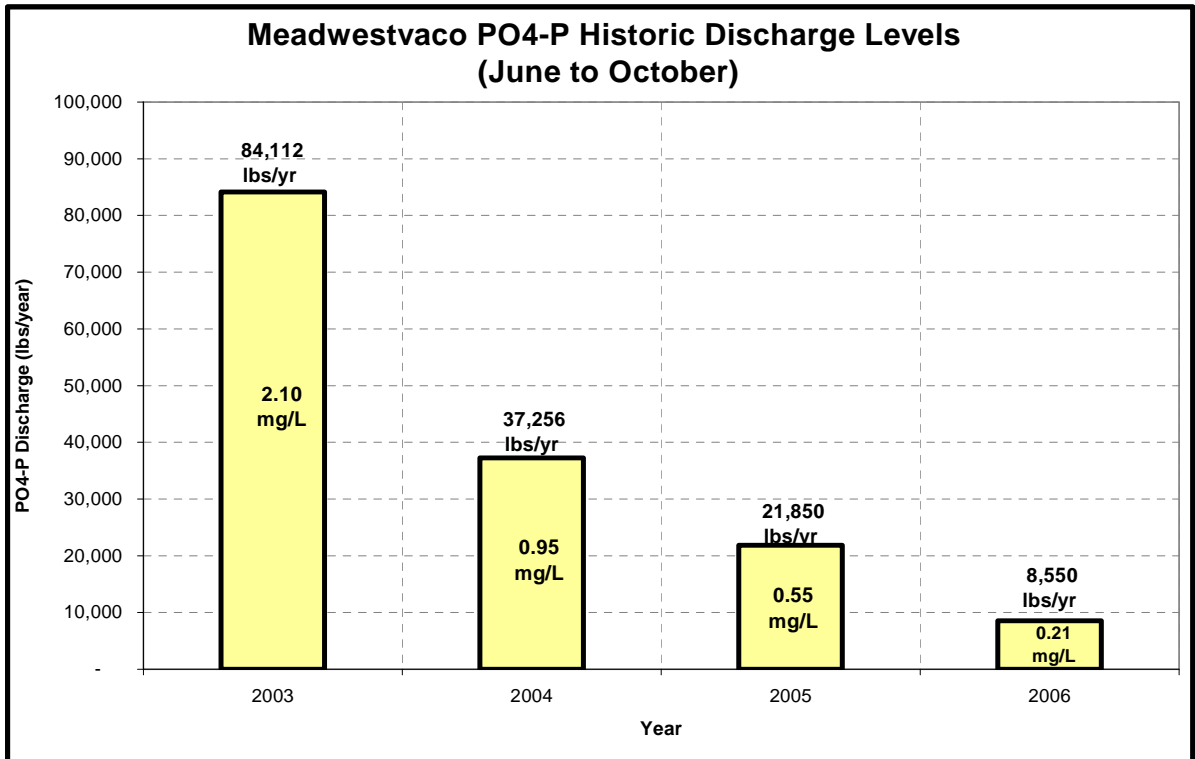


Figure 7- 1: MeadWestvaco Growing Season Historic PO4-P Discharge levels

Nutrient species distribution for the WWTPs were developed using the EPA Chesapeake Bay Program guidelines (U.S. EPA, 2008). These guidelines recommend the use of a “67/33” distribution between PO₄-P and total organic phosphorus; in other words 67% of the TP is assumed to be in the form of ortho-phosphorus (PO₄-P).

Similarly a “7/80/13” nitrogen species distribution, also recommended by the EPA Chesapeake Bay Program, is applied to the nitrogen species (NH₃/NO₃/ORGN) for the WWTPs. However, nitrogen discharge input data for the MeadWestvaco plant were developed using actual DMR data resulting in the following discharge concentrations: NH₃: 0.83 mg/l; NO₃: 0.06mg/L; and Organic Nitrogen: 2.2 mg/L.

The resulting periphyton levels resulting from the implementation of the Chesapeake Bay Scenario along with a restriction on bioavailable phosphorous discharges from

MeadWestvaco in each modeling segment of the Jackson River are depicted in **Figure 7-2**. The average periphyton level in the 15 mainstem model-segments is approximately 137 mg/m². This level is lower than the 165 mg/m² periphyton biomass resulting from the implementation of the 2006 Existing Conditions Scenario (**Chapter 6**). The main difference between these two scenarios (2006 Existing Conditions and Chesapeake Bay Scenarios) is the lower periphyton level under the Chesapeake Bay Modeling scenario below the Covington STP (Model Segment 16) caused by a decrease in nutrient discharge from the WWTPs under the Chesapeake Bay Scenario. In addition, due to the nutrient reduction under the Chesapeake Bay Scenario the modeling results indicate that the Dissolved Oxygen impairment (Page 1-3) can be delisted.

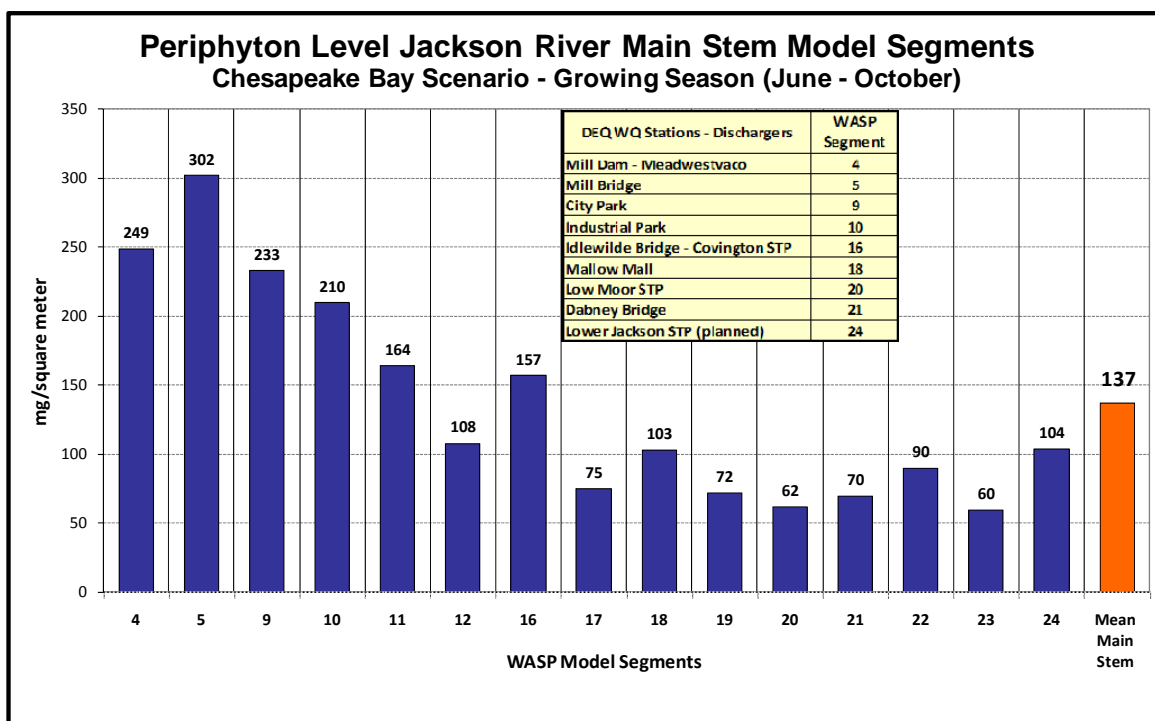


Figure 7- 2: Chesapeake Bay Modeling Scenario – Periphyton Levels Main Stem Jackson River

7.1 Flow Augmentation and Periphyton Scouring

The results of the Chesapeake Modeling Scenario indicate that the PO₄-P endpoint of 38 ug/L and the corresponding periphyton target of 100 mg/m² cannot be reached in the Jackson River. This is due to the fact that the Jackson River is not a free flowing river and also to the fact that MeadWestvaco, the main nutrient contributor to the Jackson River, has

reached its limits of technology in term of phosphorus reductions. The remaining option that will help the Jackson River achieve a healthy and balanced biological community is to mimic the natural hydrology and flows that existed before the operation of the Gathright Dam. Since it is unlikely to fully reestablish the pre-Gathright Dam hydrologic regime, VADEQ proposed that flow will be released from the dam to provide periphyton scouring and help reach the assigned endpoints. Consequently, VADEQ in cooperation with MeadWestvaco, the Philadelphia Academy of Sciences and the US Army Corps of Engineers (USACE), implemented and developed in October 2007 a flow release study where the primary objective was to assess the level of periphyton biomass scouring resulting from flow augmentation test-pulses under a flow augmentation study. The other objective was to identify the number and level of the flow pulses that can be technically feasible. The flow pulse study indicated that the pulse releases from the Gathright Dam will help the Jackson River meet the assigned endpoints. The six flow pulses of 3,000 cfs each were recommended during the growing season. **Table 7-2** depicts the pattern of one flow pulse recommended for the Jackson River flow augmentation study. The 2007 flow-pulse study led to a development of a working group consisting of VADEQ, MeadWestvaco, and USACE to study the feasibility of flow release from Gathright Dam under a USACE 216 study.

Table 7-2: Flow Augmentation Pulse Pattern			
Time	Release (cfs)	Downstream Gage	Flow Augmentation
	270	9.20	
0:00	417	9.55	147
0:30	597	9.90	327
1:00	811	10.25	541
1:30	1,061	10.60	791
2:00	1,350	10.95	1,080
2:30	1,685	11.30	1,415
3:00	2,082	11.65	1,812
3:30	2,532	12.00	2,262
4:00	3,012	12.32	2,742
4:30	3,012	12.32	2,742
5:00	3,012	12.32	2,742
5:30	3,012	12.32	2,742
6:00	2,268	11.80	1,998
6:30	1,685	11.30	1,415
7:00	1,222	10.80	952
7:30	845	10.30	575
8:00	542	9.80	272
8:30	270	9.20	

7.2 Implementation of the Chesapeake Bay Modeling Scenario with Flow Augmentation Pulses and a PO₄-P Limit for the MeadWestvaco Facility

The 216 Study will assess the feasibility and evaluate the environmental impact of flow augmentation during the growing season. Specifically, during the 216 Study there will be three release alternatives examined with varying reduced monthly minimum flows and six summer/fall pulses. In order to demonstrate that the flow releases will help restore the benthic community in the Jackson River, a modeling scenario was developed incorporating the Chesapeake Bay conditions with the recommended flow augmentation pulses. A velocity-periphyton relationship developed by the Philadelphia Academy of Natural Sciences (ANS) in artificial streamside channels was used to relate the effect of stream velocity changes on the periphyton scouring. This relationship shown in **Figure 7-3** indicates that there is a good correlation between stream velocity and periphyton biomass levels. This relationship also indicates that there is “breakpoint” velocity of 40 cm/s where periphyton starts to be scoured at higher velocity. Using this breakpoint velocity the ANS relationship shown in **Figure 7-3** was modified to develop a dimensionless relationship relating the changes in stream velocity and periphyton biomass levels (**Figure 7-4**).

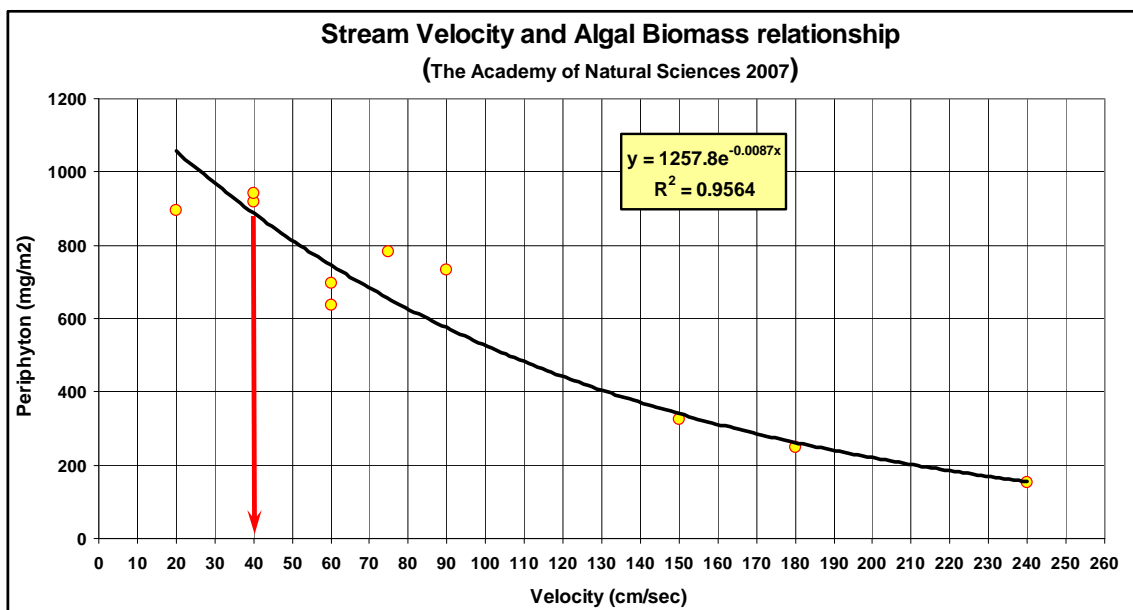


Figure 7-3: Stream Velocity and Algal Biomass Relationship

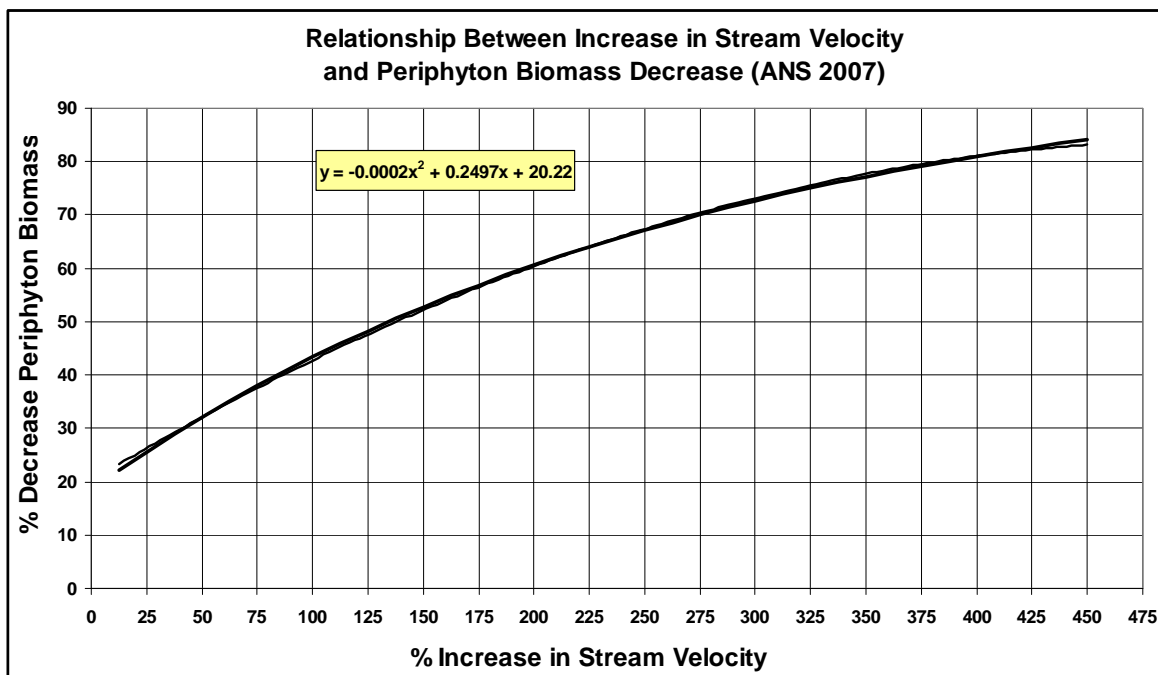


Figure 7-4: Percent Increase in Stream Velocity vs. Percent Decrease in Periphyton Biomass

The dimensionless relationship shown in **Figure 7-4** was applied to the periphyton and stream velocity time-series output from the Chesapeake Bay Scenario for each of the 15 mainstem model-segments to develop the periphyton time series resulting from the flow-augmentation pulses. The resulting periphyton levels are shown in **Figure 7-5** indicating that an average periphyton level of 101 mg/m² can be reached in the main stem of the Jackson River (**Figure 7-5**). This level of periphyton biomass is comparable to the periphyton endpoint of 100 mg/m² and will allow the Jackson River meet its aquatic life endpoint.

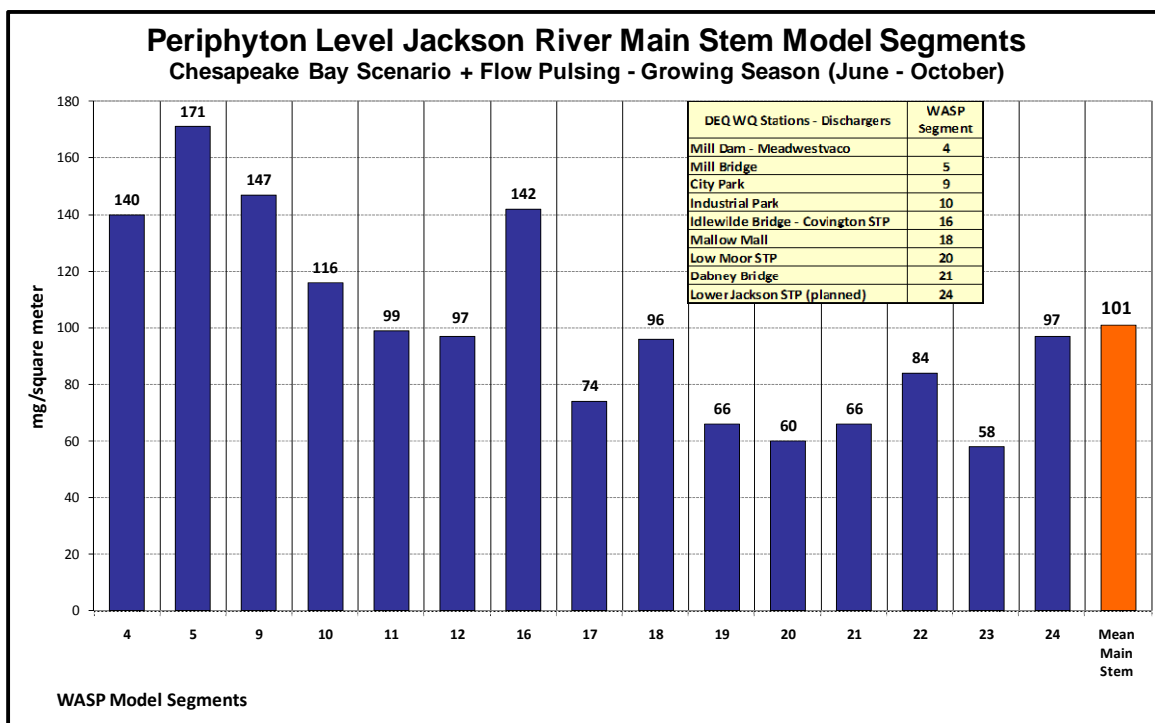


Figure 7- 5: Periphyton Levels - Chesapeake Bay Scenario with Flow Pulses

7.3 Basis for the Development of the TMDL Allocations

Typically a TMDL represents the maximum amount of pollutant that a water body can receive without exceeding the water quality standard. For the Jackson River the TMDL endpoint will be achieved using a combination of load allocations and flow pulsing in the main stem of the river. In fact, the various modeling scenarios indicated that in order to restore the Jackson River benthic community it is necessary to:

- Implement the 6 flow pulses recommended under the 216 study.
- Assign to the WWTPs the recommended Chesapeake Bay discharge levels, (except the Low Moor water treatment plant) and assign the 2006 levels in terms of PO4-P discharge for the MeadWestvaco plant.

The recommended Chesapeake Bay load and the MeadWestvaco 2006 levels which are the basis for the development of WLAs are summarized in the following tables. **Table 7-3** presents the total phosphorus loads during the growing season (June to October) and **Table 7-4** provides the corresponding total phosphorus load distribution along with the specific loads for PO₄-P and organic phosphorus.

Table 7-3: Jackson River Total Phosphorus Loads (*)				
Facility Name	VPDES Permit	Discharge Flow (MGD)	TP Conc. (mg/L)	TP Load (lbs/growing season)
MeadWestvaco	VA0003646	35	1.5	66,991
Covington STP	VA0025542	3	0.5	1,914
Low Moor WWTP	VA0027979	0.3	1.15	440
Lower Jackson River WWTP	VA0090671	2.6	0.5	1,659
Total				71,004

(*) Chesapeake Bay recommended loads for Total Phosphorus for all dischargers

Table 7-4: Jackson River PO₄-P and Organic P Waste Load(*)					
Facility Name	VPDES Permit	PO₄-P Conc. (mg/L)	PO₄-P Load Allocation (lbs/growing season)	Org P Conc. (mg/L)	Organic P Load (lbs/growing season)
MeadWestvaco	VA0003646	0.21	9,379	1.290	57,612
Covington STP	VA0025542	0.335	1,282	0.165	632
Low Moor WWTP	VA0027979	0.7705	295	0.380	145
Lower Jackson River WWTP	VA0090671	0.335	1,111	0.165	547
Total			12,068	-	58,936

(*) Chesapeake Bay recommended loads for Total Phosphorus for all the WWTPs along with a restriction to the MeadWestvaco Facility which corresponds to the 2006 PO₄-P levels

Similarly, **Table 7-5** presents the Total Nitrogen loads during the growing season and **Table 7-6** provides the corresponding total nitrogen distribution with the specific loads for ammonia (NH₃), nitrates (NO₃), and organic nitrogen.

Table 7-5: Jackson River Total Nitrogen Loads (*)

Facility Name	VPDES Permit	Discharge Flow (MGD)	TN Conc. (mg/L)	TN Load (lbs/growing season)
MeadWestvaco	VA0003646	35	3.7	165,245
Covington STP	VA0025542	3	6	22,968
Low Moor WWTP	VA0027979	0.3	14	5,359
Lower Jackson River WWTP	VA0090671	2.6	6	19,906
Total				213,478

(*) Chesapeake Bay recommended loads for Total Nitrogen for all the dischargers

Table 7-6: Jackson River NH₃, NO₃, and Organic N Loads (*)

Facility Name	NH ₃ -N Conc. (mg/L)	NH ₃ -N Load Allocation (lbs/Growing Season)	NO ₃ -N Conc. (mg/L)	NO ₃ -N Load Allocation (lbs/growing season)	Organic-N Conc. (mg/L))	Organic-N Load (lbs/growing season)
MeadWestvaco	0.83	37,068	0.1	4,466	2.8	123,710
Covington STP	0.42	1,608	4.8	18,375	0.8	2,986
Low Moor WWTP	0.98	375	11.2	4,287	1.8	697
Lower Jackson River WWTP	0.42	1,393	4.8	15,925	0.8	2,588
		40,445		43,053		129,981

(*)Recommended loads for Nitrogen species using the Chesapeake Bay speciation

7.4 Allocation

The load allocations were developed using the following equation:

$$\text{TMDL} = \sum \text{WLA} + \sum \text{LA} + \text{MOS}$$

Where,

WLA = wasteload allocation (point source contributions);

LA = load allocation (non-point source allocation); and

MOS = margin of safety.

7.4.1 Incorporation of Margin of Safety

The margin of safety (MOS) is a required component of the TMDL to account for any lack of knowledge concerning the relationship between effluent limitations and water quality. According to EPA guidance (*Guidance for Water Quality-Based Decisions: The TMDL Process, 1991*), the MOS can be incorporated into the TMDL using two methods:

- Implicitly incorporating the MOS using conservative model assumptions to develop allocations; or
- Explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations.

The MOS was implicitly incorporated into this TMDL using conservative target-setting assumptions. As described in Section 5-1, benthic chlorophyll levels in streams ranging from 100-150 mg/m² are considered excessive and at nuisance level. The Jackson River TMDL uses a conservative periphyton target of 100 mg/m², which is the low-end of the recommended “non-impaired” periphyton range of 100-150 mg/m². Therefore, the TMDL target in this TMDL is conservative eliminating the need for an explicit margin of safety.

7.4.2 Jackson River Waste Load Allocations

The basis for the development of the WLAs for the major dischargers was presented in Section 7.3 and consists of the following:

- **Implement the 6 flow pulses recommended under the 216 study.**
- **Assign to the WWTPs the recommended Chesapeake Bay discharge levels, (except the Low Moor water treatment plant) and assign the 2006 levels in terms of PO₄-P discharge for the MeadWestvaco plant.**

Tables 7-7 and 7-8 present the major dischargers’ WLAs for total phosphorus and total nitrogen respectively.

Table 7-7: Phosphorus Waste Load Allocations - Major Dischargers

Facility Name	VPDES Permit	Discharge Flow (MGD)	TP Conc. (mg/L)	TP Load Allocation (lbs/growing season)	PO4-P Conc. (mg/L)	PO4-P Load Allocation (lbs/growing season)
MeadWestvaco	VA0003646	35	1.5	66,991	0.21*	9,379
Covington STP	VA0025542	3	0.5	1,914	0.335	1,282
Low Moor WWTP	VA0027979	0.3	1.15	440	0.7705	295
Lower Jackson River WWTP	VA0090671	2.6	0.5	1,659	0.335	1,111
Total				71,004	-	12,068

*Measured as filtered orthophosphorus

Table 7-8: Total Nitrogen Waste Load Allocations During the Growing Season Major Dischargers

Facility Name	VPDES Permit	Discharge Flow (MGD)	TN Conc. (mg/L)	TN Load (lbs/growing season)
MeadWestvaco	VA0003646	35	3.7	165,245
Covington STP	VA0025542	3	6	22,968
Low Moor WWTP	VA0027979	0.3	14	5,359
Lower Jackson River WWTP	VA0090671	2.6	6	19,906
Total				213,478

The allocation for Low Moor WWTP and Lower Jackson River WWTP reflect the aggregated mass load nutrient given to Alleghany County pursuant to 9VAC 25-820-70, Part 1.B.2, otherwise referred to as a "bubble". Accordingly, compliance is determined solely on an aggregate basis rather than by comparison of individual facility waste load allocations.

In addition to the major dischargers, there are 9 active minor facilities holding active individual discharge permits in the Jackson River watershed (4 industrial facilities and 5 municipal facilities). The 4 minor industrial facilities discharge very low level of nutrients. Based on DMR data for a few industrial facilities, the average discharge TP is approximated at 0.34 mg/L and 0.14 mg/l for total nitrogen and total phosphorus, respectively. **Table 7-9** presents the WLAs for the 4 minor industrial facilities for total phosphorus and total nitrogen respectively.

**Table 7-9: Total Nitrogen and Total Phosphorus Waste Load Allocations
Minor Industrial Facilities**

Permit Number	Facility Name	Design Flow (gpd)	TP Load (lbs/growing season)	TN Load (lbs/growing season)
VA0003450	Applied Extrusion Technologies	1,000,000	178.4	395.0
VA0006076	Clifton Forge Water Treatment Plant	50,000	8.9	19.7
VA0003344	CSX Transportation Inc - Clifton Forge	25,000	4.5	9.9
VA0091324	DGIF Paint Bank Fish Cultural Station	2,900,000	517.3	1145.4
Total			709	1,570

The nutrient allocations for the 5 minor municipal dischargers are developed using recommended literature values related to primary treatment levels for total phosphorus (10 mg/L) and total nitrogen (40 mg/L) (Thomann, 1987). **Table 7-10** presents the WLAs for the 5 minor municipal facilities for total phosphorus and total nitrogen respectively.

Table 7-10: Total Phosphorus Waste Load Allocations – Minor Municipal Facilities

Permit Number	Facility Name	Design Flow (gpd)	TP (lbs/growing season)	TP (lbs/growing season)
VA0088544	Boys Home Inc STP	24,000	305.8	1223.1
VA0032115	Morris Hill STP	15,000	191.1	764.4
VA0088552	Sponaugle Subdivision	16,000	203.9	815.4
VA0090646	Tanglewood Manor Home for Adults	18,000	229.3	917.3
VA0075574	VDOT I64 Rest Area - Alleghany County	15,000	191.1	764.4
			1,121.2	4,484.8

There are also 18 general permits in the Jackson River watershed; 3 permits issued to domestic sewage facilities 11 stormwater permits issued to industrial sites, 2 permits issued to mines, 1 stormwater permit issued to a construction site, and 1 stormwater permit issued to a concrete facility.

The WLA for the domestic sewage facilities were developed using similar nutrient discharge assumption as the one used the minor municipal facilities along with a maximum discharge flow of 1,000 gallons per day. **Table 7-11** presents the total phosphorus and total nitrogen WLAs for the 3 domestic sewage facilities.

Table 7-11: Total Nitrogen and Total Phosphorus Waste Load Allocations Domestic Sewage Facilities				
Permit Number	Facility Name	Design Flow (gpd)	TP Load (lbs/growing season)	TN Load (lbs/growing season)
VAG402026	Residence	1000	13	51
VAG402094	Residence	1000	13	51
VAG402098	Residence	1000	13	51
Total			39	153

The remaining 15 general stormwater permits were lumped together for the estimation of the WLA. The following assumptions were used to develop the WLA for the general stormwater permits:

- The facilities consist of industrial land-use type
- The total acreage of all the general stormwater permits was estimated at 150 acres
- The average TP unit load is estimated at 1.46 kg/ha-year. (Terrene Institute and USEPA 1994)
- The average TN unit load is estimated at 8.0 kg/ha-year (Lin 2004)

Table 7-12 presents the nutrient WLAs for the general stormwater permits for total phosphorus and total nitrogen respectively.

Table 7-12: Total Nitrogen and Total phosphorus Waste load Allocations Stormwater General Permits			
Number of General Stormwater Permits	Total Acreage (acres)	TP Load (lbs/growing season)	TN Load (lbs/growing season)
15	150	82	448
Total		82	448

The recommended waste load allocations for each source within the watershed are summarized in **Table 7-13**.

Table 7-13: Summary of Recommended Waste Load Allocations in the Jackson River				
Facility Name	Reference Tables in Report	TP Load (lbs/growing season)	PO4-P (lbs/growing season)	TN (lbs/growing season)
Major Point Source Dischargers	7-7 & 7-8	71,004	12,068	213,478
Minor Industrial Facilities	7-9	709		1,570
Minor Municipal Dischargers	7-10	1,121	-	4,484.8
Domestic Sewage Facilities	7-11	39	-	153
General Stormwater Permits	7-12	82	-	448
		72,955	12,068	220,134

7.4.3 Jackson River Load Allocation

The nonpoint sources modeling presented in **Chapter 6** resulted in an average PO₄-P load during the growing season of 1,930 lbs. This corresponds to a TP load of 2,880 lbs during the growing season. Similarly, the nonpoint source modeling resulted to an average TN load of 24,160 lbs during the growing season. No reductions are applied to the nonpoint source loads.

7.4.4 Jackson River TMDL

A summary of the TMDL allocations for the Jackson River are presented in **Table 7-14** and **Table 7-15** for total phosphorus and total nitrogen respectively. Section 7-4-5 provides the reasonable assurance that the Jackson River TMDL will be implemented through regulatory actions by Federal and State Agencies.

Table 7-14: Jackson River Total Phosphorus TMDL (lbs/growing season)

WLA (Point Sources)	LA (Non-point sources)	MOS (Margin of Safety)	TMDL
72,955	2,880	Implicit	75,835

Table 7-15: Jackson River Total Nitrogen TMDL (lbs/growing season)

WLA (Point Sources)	LA (Non-point sources)	MOS (Margin of Safety)	TMDL
220,134	24,160	Implicit	244,294

TMDL allocations expressed on a daily basis are presented in **Table 7-16** and **Table 7-17** for total phosphorus and total nitrogen respectively. Since the Jackson River is dominated by the point sources loads with relatively constant discharge flow, the daily TMDL are estimated by dividing by 153 (number of days in the growing season) the growing season TMDL equations presented in **Tables 7-16** and **7-17**.

Table 7-16: Jackson River Total Phosphorus TMDL (lbs/day)

WLA (Point Sources)	LA (Non-point sources)	MOS (Margin of Safety)	TMDL
476.8	18.8	Implicit	495.7

Table 7-17: Jackson River Total Nitrogen TMDL (lbs/day)

WLA (Point Sources)	LA (Non-point sources)	MOS (Margin of Safety)	TMDL
1438.8	157.9	Implicit	1596.7

7.4.5 Reasonable Assurance

The upper Jackson River and its current flow have been managed by a low flow augmentation scheduled that was established by the USACE in 1981. The existing low flow regime was implemented to address high BOD and low DO conditions of the stream at Covington. Over the past 30 years, there have been significant reductions in the amount of BOD discharged and DO conditions have improved. Today, excessive nutrients periphyton has replaced BOD as the pollutant of concern in this section of the river.

The Jackson River TMDL is recommending the existing flow augmentation schedule be modified to restore some natural stream flow variability. The proposed flow release modification is to remediate current instream habitat impairments caused by excessive periphyton growth. This change will simulate or mimic natural storm events, particularly during the critical growing period of the periphyton. The TMDL modeling and monitoring studies have demonstrated pulses during critical periods will remove excess periphyton. This action results in improved biological communities in the river below Covington.

Therefore, this TMDL is unique since the implementation consists of pulsing the flow in the main stem of the Jackson River. The flow augmentation study, insuring that the Virginia aquatic life standards will be met, is being implemented and finalized through a

216 study authorized by Section 216 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611), dated 31 December 1970, which states:

“The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest.”

The overall purpose of the flow augmentation feasibility study is to ensure the timely and economical completion of a quality Feasibility Report that will review the existing conditions of the Gathright Dam and Lake Moomaw Federal project to determine if any changes to release procedures would significantly enhance **habitat and benefit water quality downstream** of the project on the Jackson River to the confluence with the head of the James River. The primary focus of the study will be directed to fine tuning the water release procedures during low flow conditions by incorporating new techniques, such as pulsing, to better mimic natural stream conditions that occurred before the project existed. These release modifications shall be developed to protect the in-lake fishery and downstream fisheries. Habitat enhancement shall address benthic organisms, siltation, and water quality. The Feasibility Study shall be fully consistent with and in support of the goals, mandates, and direction of the Chesapeake Bay Agreement and other pertinent state and Federal statutes and initiatives.

EPA uses the term “*reasonable assurance*” to emphasize that implementation of a TMDL is critical to the ultimate attainment of standards in the impaired waterbody. Reasonable assurance is defined as “a *demonstration that the TMDL will be implemented through regulatory or voluntary actions, by Federal, State or local governments, authorized tribes or individuals*” (EPA, 2000). There is a reasonable assurance that the 216 study will be implemented through flow pulsing in the main stem of the Jackson River leading to the attainment of the identified endpoint. In fact, the US Army Corps of Engineers and the VADEQ entered and signed an official agreement funding the 216 study and insuring that

the flow augmentation study will be implemented and completed in the next 3 years. In fact and as shown in **Table 7-18**, a Feasibility Cost Sharing Agreement (FCSA) between the USACE Norfolk District and the Commonwealth of Virginia, the study's local sponsor, was executed in December 21st 2009. A Project Management Plan (PMP) was also approved outlining all the steps necessary for the conduct of the 216 study. In addition, memorandums of understanding (MOAs) were executed between VADEQ, MeadWestvaco and the Virginia Department of Game and Inland Fisheries (DGIF) for the development of a monitoring Quality Assurance Project Plan (QAPP) and the coordination of the monitoring plan itself.

Table 7-18: Agreements and Planned Phases of the 216 Flow Augmentation Study

FCSA Execution	December 21, 2009	December 21, 2009
PMP Execution	February 5, 2010	February 1, 2010
State Funds/Work In Kind Received	February 5, 2010	February 1, 2010
Initial Coordination Meeting	March 24, 2010	-
Peer Review Plan Approved	April 2, 2010	-
AFB Briefing	October 24, 2011	-
DRAFT 216 Study Report	May 15, 2012	-

7.4.6 Seasonal Variations

The Jackson River TMDL was developed by linking two dynamic/continuous models: HSPF and WASP. These two models explicitly accounts for seasonal variations in hydrology, climatic conditions, and watershed activities in order to establish the allocations. Therefore, the development of the Jackson River benthic TMDL effectively considered seasonal environmental variations.

7.4.7 Critical Conditions

According to the EPA regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality in the Jackson River is protected during times when it is most vulnerable. This TMDL directly addresses the

critical conditions since all the allocations were developed during the periphyton growing season spanning June to October. The growing season is the most critical time in the Jackson River where conditions such as low flow and high temperature are most favorable to periphyton growth.

7.4.8 Background Pollutant Contributions

Natural background is included as a component of the load allocations. The load allocations were developed using the calibrated EPA Chesapeake Bay Watershed Model (HSPF) where the nutrient loads include the naturally occurring as well as human-induced contributions. The model was calibrated to water quality data that represents the cumulative impact from all sources—naturally-occurring and human-induced combined.

MEMORANDUM
DEPARTMENT OF ENVIRONMENTAL QUALITY - WATER DIVISION
Water Permitting, West Central Regional Office
3019 Peters Creek Road, Roanoke, VA 24019-2738

SUBJECT: Flow Frequency Determination, MeadWestvaco - #VA0003646
TO: Permit reissuance fact sheet
FROM: Susan K. Edwards, Environmental Engineer Senior, Water Permitting - WCRO
DATE: December 30, 2011

This memo updates the November 2006 memos concerning the subject VPDES permit.

MeadWestvaco discharges treated industrial process wastewater, via 1 outfall, to the Jackson River above Dunlap Creek in Covington, Virginia. Stormwater is discharged from the industrial site through the treatment plant outfall on the Jackson River as well as through other outfalls on the Jackson River and Dunlap Creek. Stream flow frequencies are required at the treatment plant outfall for the purpose of developing effluent limitations for the VPDES permit.

The flow in the Jackson River is governed by a minimum release requirement on the operation of The Gathright Dam by the U.S. Corps of Engineers. The minimum release from the dam to the Jackson River occurs during the months of January and December and equals 158 c.f.s. at the target area just above Dunlap Creek.

Jackson River minimum monthly release rates from Gathright Dam:

<u>Month</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<u>Flow (c.f.s.)</u>	158	168	171	194	231	269	283	278	245	188	161	158

The flow frequencies at the wastewater treatment plant discharge (outfall 003) must take into account water withdrawals upstream of this location. Since the 2001 Flow Frequency Memorandum MeadWestvaco has eliminated the withdrawals for and discharges of non-contact cooling water. Since 2001 MeadWestvaco has not had a withdrawal for fire protection, carbon storage nor the wood yard. They continue to operate a raw water intake from the Jackson River. The City of Covington water treatment plant, just upstream of the industrial plant, continues to withdraw water also. With minimum release rates from Gathright Dam occurring during January and December withdrawal rates during those months from these two locations will be averaged over the most recent 4-year period, January 2007 - December 2010:

MeadWestvaco raw water intake = 56.75 c.f.s.

Covington WTP water intake = 3.36 c.f.s.

The critical flow at the MeadWestvaco wastewater treatment plant discharge, outfall 003, is:

$$158 \text{ c.f.s.} - 56.75 \text{ c.f.s.} - 3.36 \text{ c.f.s.} = 97.9 \text{ c.f.s.} = \mathbf{63.2 \text{ MGD}}$$

Since there is a minimum release rate from the Gathright Dam, the range of flow frequencies will not change. The 1Q10, 7Q10, 30Q5 HF 7Q10 and harmonic mean will all be equal.

This analysis assumes there are no other significant discharges, withdrawals or springs influencing the flow between the dam and the discharge point.

Change from 2007 reissuance is a slight increase in the minimum flow expected:

63.2 MGD – 62.6 MGD = 0.6 MGD which is slightly less than a 1% increase in the minimum flow

STORET Data Station ID 2-JKS030.65
Station Dscrptn Route 687 Bridge, Clearwater Park - Alleghany County

Collection Date	Temp (°C)	pH (s.u.)	Collection Date	Hardness (mg/L CaCO3)	<u>wet season values</u>	
					Temp (C)	pH (s.u.)
01/10/07	7.2	7.1	01/09/01	88.9	13.9	7.5
03/22/07	8.3	7.6	02/01/01	85.3	17.4	7.6
05/15/07	13.9	7.5	03/01/01	45.7	10	7.1
07/26/07	17.4	7.6	04/02/01	59.1	17.7	8.2
11/19/07	10	7.3	05/01/01	43.4	15.2	8
01/08/08	7.8	7.4	06/05/01	75.9	8.5	7.4
03/13/08	9	7	07/19/01	41.6	17	8.1
03/25/08	7.8	6.9	08/16/01	74.4	16.5	8
05/07/08	10	7.1	09/10/01	74.1	8.5	7.9
07/29/08	17.7	8.2	10/10/01	72.5	18.7	7.8
09/22/08	15.2	8	11/28/01	57.9	18.6	8
11/24/08	4.9	8.3	12/18/01	72.6	15.4	7.9
01/22/09	1.4	7.9	01/22/02	76.8	9.3	7.8
03/11/09	9	7.8	02/19/02	69.6	18.1	7.7
05/05/09	8.5	7.4	03/26/02	94.7	17.6	8
07/07/09	17	8.1	04/17/02	100	15.8	8.1
09/02/09	16.5	8	05/23/02	72.9	15.6	8
11/30/09	12	7.8	06/17/02	87.6		
02/24/10	4.2	7.6	07/18/02	75.6		
04/01/10	8.5	7.9	08/07/02	74.8		
06/16/10	18.7	7.8	09/17/02	157.5		
08/16/10	18.6	8	10/21/02	82.6		
10/26/10	15.4	7.9	11/18/02	84.2		
12/29/10	2	8.2	12/16/02	63.7		
02/16/11	4.1	8	02/03/03	80.9		
04/19/11	9.3	7.8	03/03/03	62.8		
06/22/11	18.1	7.7	03/24/03	50.7		
08/16/11	17.6	8	05/01/03	31.1		
09/28/11	15.8	8.1	06/19/03	80.7		
10/12/11	15.6	8				

Wet season is assumed to be April - Oct of each year. (shaded values for temp & pH)

Mean Hardness	73.7	(mg/L CaCO3)
90th% temp annual	17.74	(°C)
90th% temp wet	18.3	(°C)
90th% pH annual	8.11	(s.u.)
90th% pH wet	8.1	(s.u.)



COMMONWEALTH of VIRGINIA

DEPARTMENT OF HEALTH

OFFICE OF DRINKING WATER

Lexington Field Office

Karen Remley, MD, MBA, FAAP
State Health Commissioner

J. Wesley Kleene, PhD, PE
Director, Office of Drinking Water

131 Walker Street
Lexington, VA 24450
Phone: 540-463-7136
Fax: 540-463-3892

MEMORANDUM

DATE: August 29, 2011

TO: Susan Edwards, Environmental Engineer Senior
DEQ-Blue Ridge Regional Office

FROM: Douglas M. Caldwell, P.E., Engineering Field Director *DMC*
VDH-ODW-Lexington Field Office

CITY/COUNTY: Alleghany County

SUBJECT: Water – Mead Westvaco (Covington Operations)

☒ VPDES ☐ VPA ☐ VWP No. VA0003646

☐ Other _____

☒ Existing ☐ Proposed ☐ Modification

OWNER/APPLICANT: Mead Westvaco of Virginia, Inc.

- ☒ There are no public water supply raw water intakes located within 15 miles downstream or one tidal cycle upstream of the discharge.
- ☐ The public water supply raw water intake for _____ is located _____ miles [downstream/upstream] from the discharge. We recommend a Reliability Class _____ or higher for this facility.
- ☐ The public water supply raw water intake for _____ is located _____ miles [downstream/upstream] from the discharge.
- ☐ Please forward a copy of the Draft Permit for our review and comment.
- ☐ Other Comments:

Receiving waters – Jackson River

Prepared by: Jesse Mayhew, District Engineer *JM*

JDM/kl/110829.2

cc: VDH – ODW – Richmond Central